

Below is a computer generated image that provides an analyst a great deal of information as to how a part of a mechanical system will bear up under stress. It was created by a new method of analyzing components, from aircraft and combustion engines to electric shavers and automotive parts.

Known as GPBEST (General Purpose Boundary Element Solution Technology), the software package is a commercial derivative of a computer code originally developed under NASA sponsorship, distributed by Boundary Element Software Technology Corporation, Getzville, New York. As its name indicates, GPBEST employs the boundary element method (BEM) of mechanical engineering analysis, as opposed to finite element analysis (FEA), the dominant method. Although BEM theory dates back almost a century, it had shortcomings that stunted its commercial development until recently, when the advent of advanced, powerful computers and advances in linear algebra elevated BEM to its status as a cost-effective alternative to traditional analysis methods.

"Use of the boundary element method will result in less expensive products because it allows them to move more quickly from the design stage to manufacturing," says Dr. Prasanta K. Banerjee, professor of civil engineering at SUNY/Buffalo (State University of New York at Buffalo) and leader of a NASA-funded research project that explored BEM in the mid-1980s. The boundary element method, he states, is 10 times faster in data preparation and more accurate than the FEA approach most companies use.

BEM functions on the premise that any region of a system's volume may be analyzed by being subdivided into sections consisting only of surfaces — rather than three-dimensional elements. By calculating the surfaces, predictions can be made about a system's internal behavior, so BEM in effect solves three dimensional volume problems as two dimensional surface problems; In this manner, a thorough analysis can be obtained in a fraction of the time normally required.

The GPBEST software stemmed from a technology foundation created in a research effort initiated in 1982 by Lewis Research Center. NASA funded BEM research by Pratt & Whitney division of United Technologies and Dr. Banerjee's SUNY/Buffalo group. A significant product of that research was the BEST 3D (Boundary Element Solution Technology in Three Dimensions) computer code. Although BEST 3D was a "research level" code, it generated wide interest in the computational mechanics community because of its breakthrough potential for solid and structural mechanics applications, so NASA released BEST 3D publicly.

There remained a clear need for a commercial derivative software product. Beginning in 1989, Dr. Banerjee developed the commercial GPBEST and founded BEST Corporation to market it. The software is in wide use for solving such problems as stress analysis, heat transfer, fluid analysis and the yielding and cracking of solids. GPBEST is being used by Deere & Company to design tractor parts, by Mercedes Benz and General Motors for auto parts, by Pratt & Whitney for aerospace parts, Braun for household appliances and Nissan for acoustic analysis.

